

DOCUMENT RESUME

ED 128 908

EA 008 679

TITLE Energy Management Guide for Building Management.
Electricity.
INSTITUTION Consolidated Edison Co., Brooklyn, N.Y.
PUB DATE Sep 73
NOTE 21p.
EDRS PRICE MF-\$0.83 HC-\$1.67 Plus Postage.
DESCRIPTORS *Building Operation; Climate Control; *Electricity;
Elementary Secondary Education; *Energy Conservation;
*Guidelines; Higher Education; Lighting; School
Buildings

ABSTRACT

This guide is intended for use by commercial building management and operating staffs to encourage energy conservation. The measures suggested are meant to allow building operation at optimum efficiency while minimizing energy waste. Though mainly applicable to multistory buildings, the suggested energy conservation measures are also adaptable to other commercial structures such as educational facilities. Specific topics discussed include controllable electric billing elements, electric energy charges, electric demand charges, unnecessary air conditioning, unnecessary lighting, tips on lighting economy, and tips on reducing electric demand. (Author/JG)

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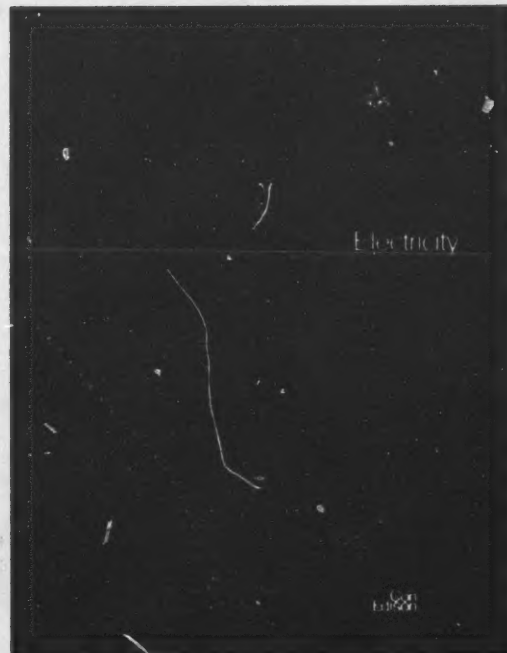
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Electricity

Con Edison

Energy Management Guide / Electricity

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Introduction

This Energy Management Guide has been compiled by Con Edison for the use of commercial building management and operating staffs to encourage energy conservation. The measures suggested are intended to allow operation at optimum efficiency while minimizing the waste of vital energy resources.

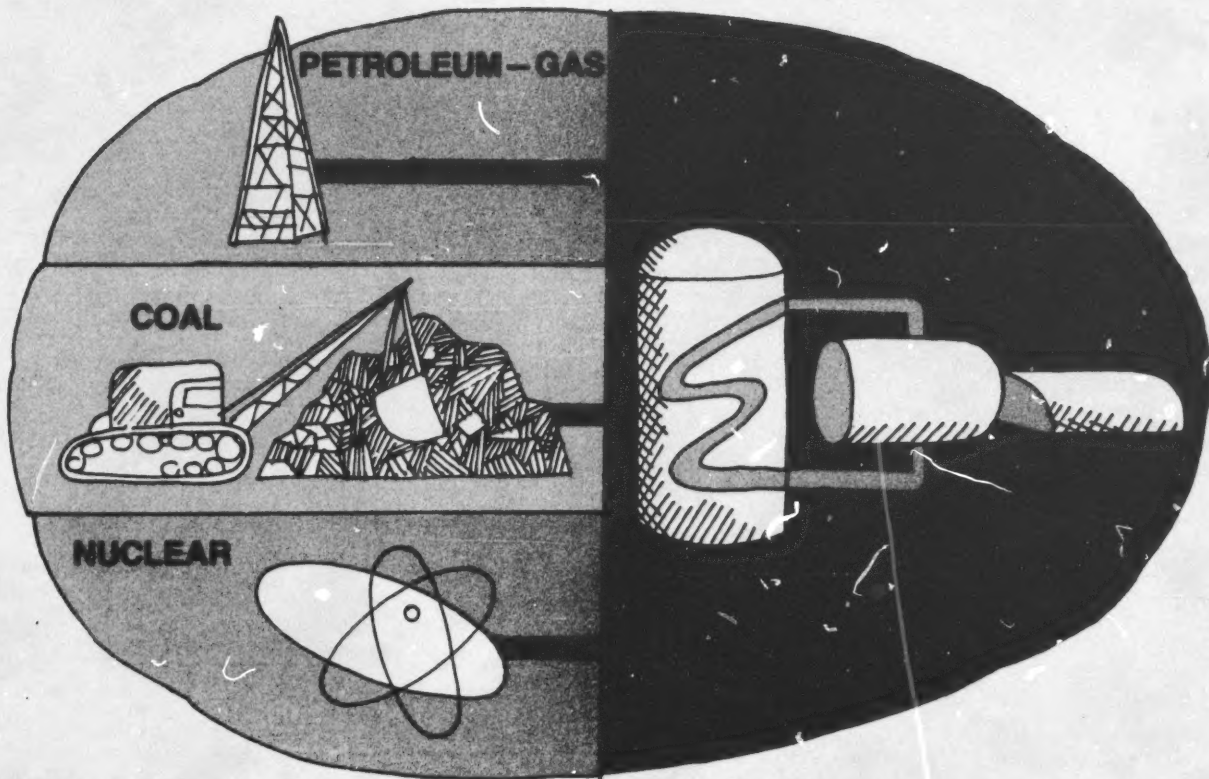
Though essentially applicable to multi-storied office buildings, the energy conservation measures suggested in this Guide also are adaptable to other types of commercial structures such as loft buildings and department stores as well as educational facilities and larger apartment buildings.

Additional copies may be obtained through the Con Edison Commercial Services offices at any of the following company locations:

Brooklyn — 30 Flatbush Avenue
Bronx — 310 East Kingsbridge Road
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Credit is acknowledged to U.S. Government, General Services Administration whose manual "Conservation of Utilities" inspired this Guide and served as its basic model.





Why conserve energy?

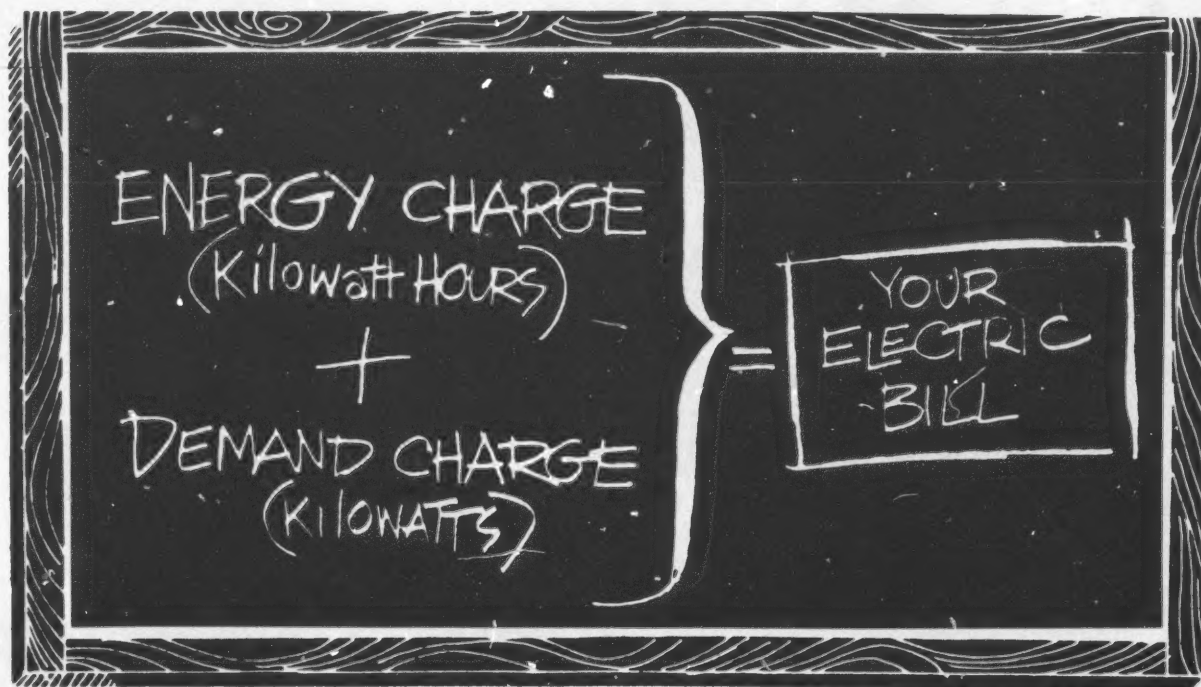
Because it is National Policy based on national necessity.

Because as a nation we are wasting vital energy resources at an alarming rate, and are tapping energy sources faster than they are being developed.

Because prevailing economic conditions and trends indicate the cost of energy—"raw" energy such as coal, petroleum and natural gas and "processed" energy such as electricity and central station steam—is going up, and will continue to go up.

Because it is "good management" to operate a business as efficiently and economically as possible, to minimize expenses and maximize profits.

Energy conservation in commercial operations can help you cut costs and increase profits



Electric Billing Elements you can control

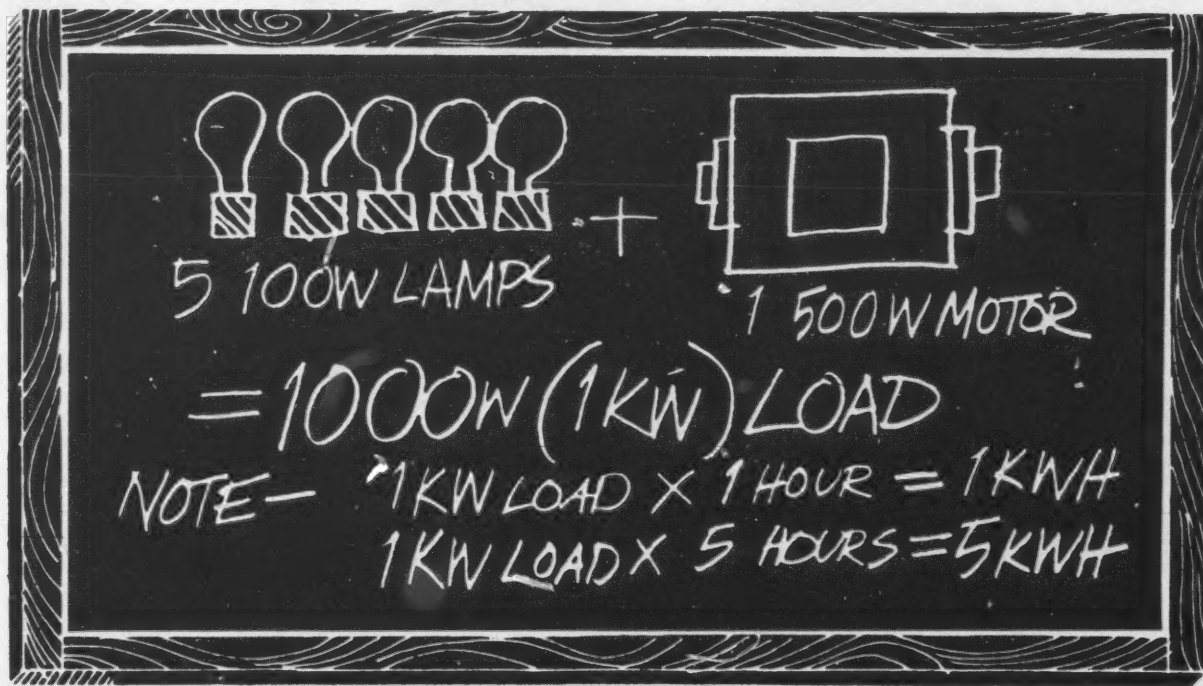
Energy conservation measures can reduce appreciably the energy and demand elements of your electric bills, thus producing an immediate operating benefit to you in the form of lower electric costs.

The two elements of your electric billing over which you can exercise a degree of control are:

- **Energy**—expressed in kilowatthours (kwh). This indicates the amount of electricity used during the entire billing period.

- **Demand**—expressed in kilowatts (kw). This indicates the greatest amount of electric power you required in your operations during the billing period, based on your highest half-hour-average load.

If you operate with less electricity (kwh) overall through the billing period and if you spread out your usage to reduce your demand (kw) on Con Edison's system, your electric bills will be lower.



Electric Energy Charge

The first controllable element of your electric bill is the *energy charge*. Energy is the power required to operate lights and equipment over a period of time.

For example, a load of five 100-watt lamps and one 500-watt motor amounts to 1000 watts, or 1 kilowatt (kw). If you run this equipment for one hour, you consume 1 kilowatthour (kwh) of electricity. After five hours you have used 5 kwh, and so on.

The energy charge on your electric bill is based on your total consumption of kilowatthours throughout the entire billing period.

The best way to conserve electric energy and reduce kilowatthours used is to turn off equipment and lights when not needed.

Some of the ways you can do this are described in the following pages.



Don't waste energy on unnecessary air conditioning

Equipment Settings. Air conditioned work areas should be comfortable, not frigid. Keeping a building too cool wastes energy. The following is generally recommended for comfort and economy: adjust equipment to provide an inside temperature no lower than 15 degrees below outside temperature, down to a minimum inside level of 76 degrees.

However, when re-heat is involved, setting the thermostat to a higher temperature may actually use more energy. Your system should be analyzed individually and the setting selected for satisfactory temperature and humidity control as well as for maximum energy conservation.

Avoid After Hours Waste. Building air conditioning should be turned off when occupants leave, and not turned back on again until shortly before the business day starts again.

Adjust morning start-up time for extreme weather, or to compensate for week-end or holiday heat build-up.

But remember, continuous air conditioning wastes energy and money. It is *not* cheaper to run it constantly.

Special Requirements. If you require round-the-clock air conditioning in special areas—such as for computer equipment—consider "package" or individual air conditioning installations to cool such areas independently of the rest of the building. It will save you money in the long run.



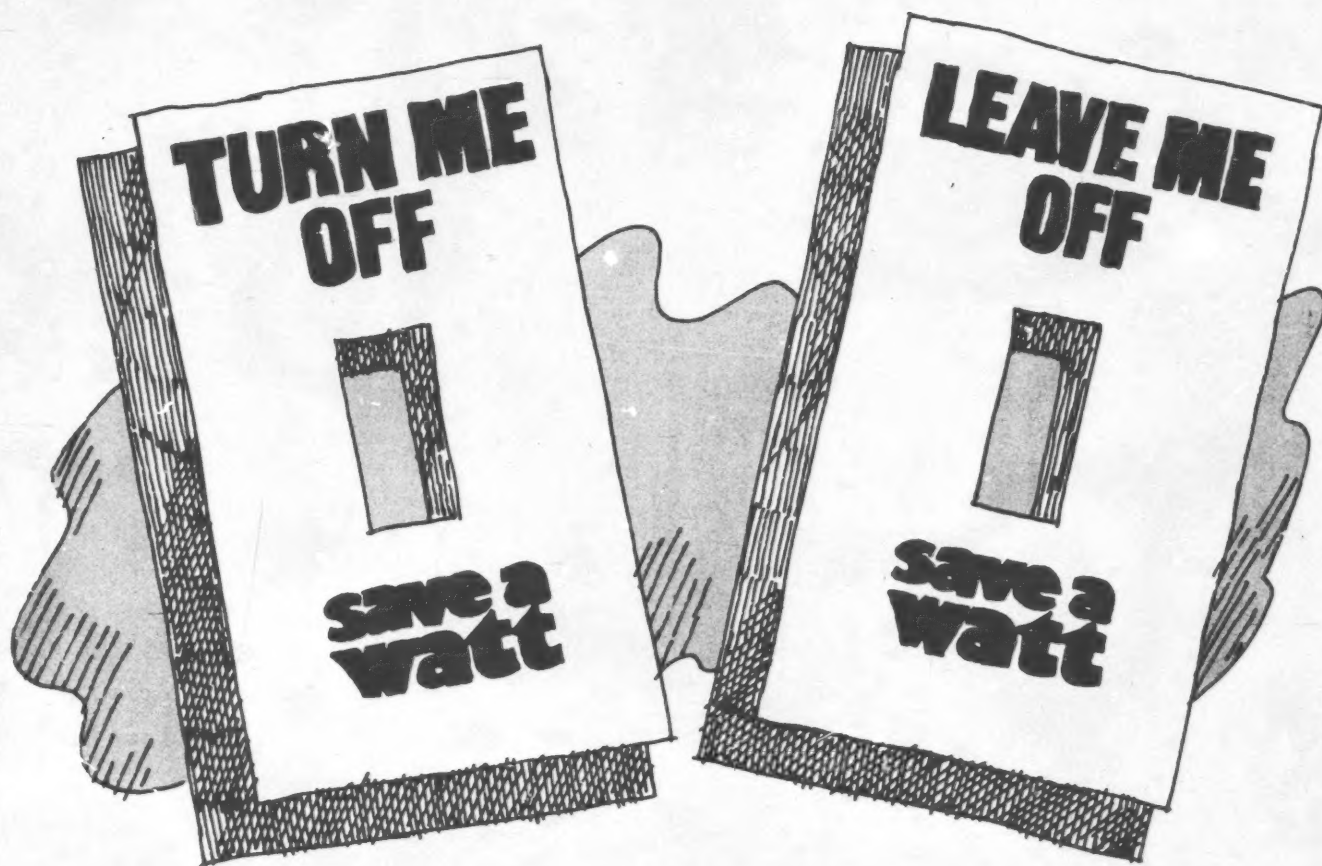
Don't waste energy on unnecessary lighting

Good lighting is essential. But unnecessary lighting or excessive lighting is wasteful and costly.

*Lighting is a big part of your energy requirement. For example, it costs about \$70.00 an hour to light a 500,000 net-square-foot office building in this area. If lighting requirements for such a building could be reduced 10 percent, the owner could save about \$2,500 a month.**

Lighting Creates Heat. Reduced lighting intensity will also reduce summertime air conditioning requirements, a double saving. (In winter, of course, lighting's by-product heat cuts down on space heating requirements.)

*Based on an assumed lighting load of 4 watts per square foot in an office building in Con Edison's service area billed at S.C. 9 (General-Large) rates prevailing June, 1973, including fuel adjustment, but excluding sales tax.



Tips on Lighting Economy

Lower Lighting Levels. You can reduce lighting loads and conserve energy by turning off lights, or reducing lighting intensity wherever possible.

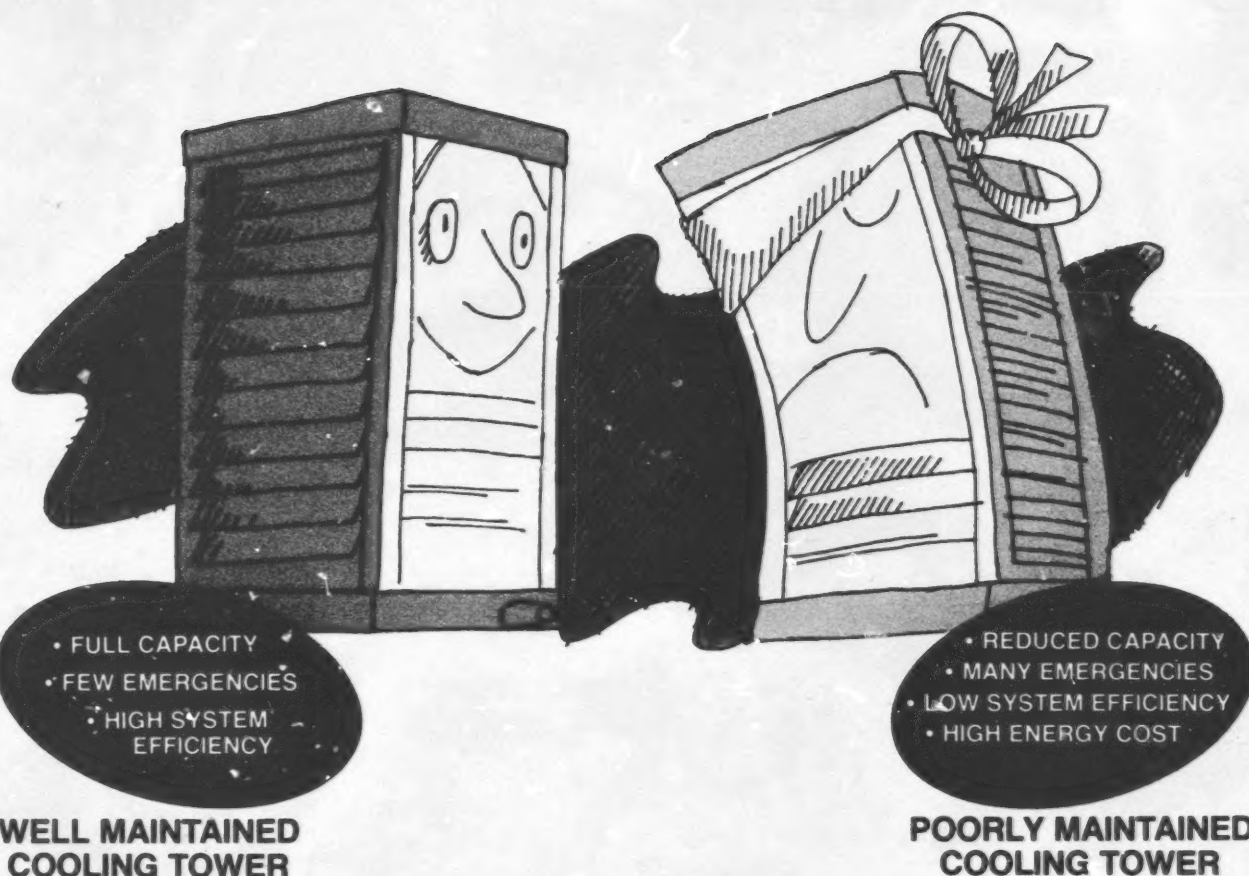
Turn off lights when they are not needed all the time in such areas as storerooms, supply closets, or conference rooms.

Turn off, or reduce the use of decorative lighting.

Reduce lighting levels in non-work areas such as hallways and arcades, and in perimeter offices when natural daylight is sufficient.

Use Fluorescent Lighting. Fluorescent lights are about four times more efficient than incandescent lights, and last 7 to 10 times longer.

It's true, turning fluorescent lights on-and-off does shorten lamp life. But, the break-even point is about 20 minutes, based on our rates. So, it's still more economical to turn fluorescent lights off when space will be unoccupied for a half-hour or longer.



Equipment maintenance helps conserve energy

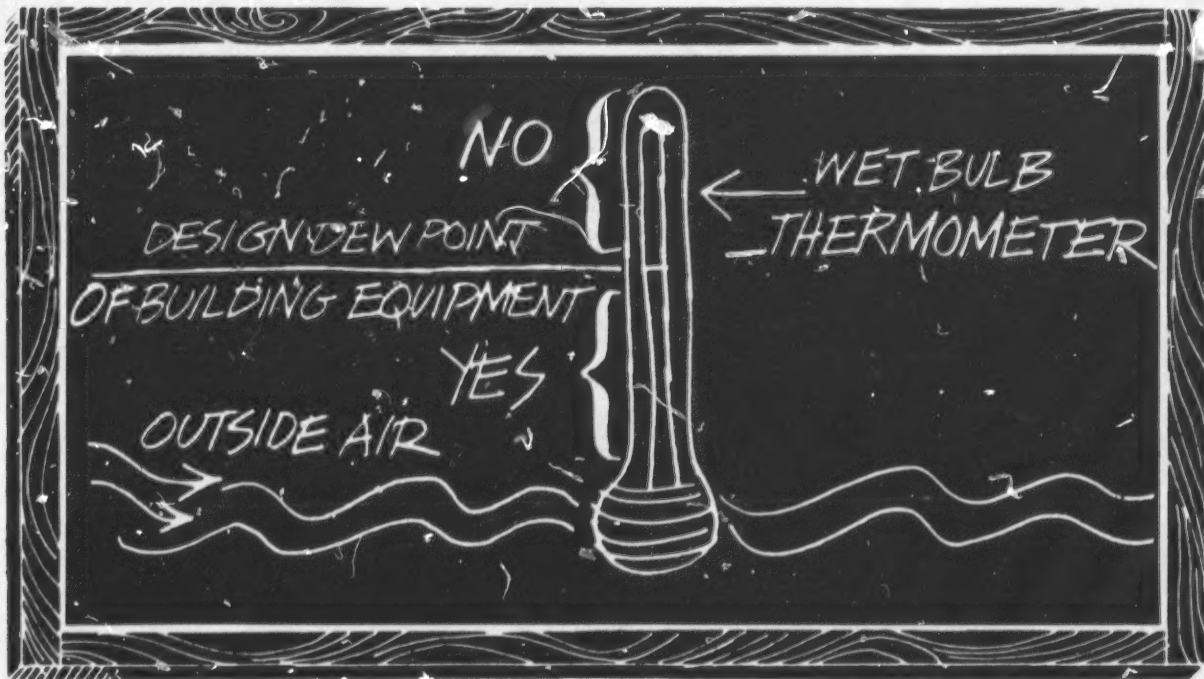
Well maintained equipment runs better and uses less electricity.

For example, a very thin scale build-up on condenser tubes can cut a chiller's capacity by as much as 25 percent.

Poorly maintained cooling towers with warped fill, or latticework, and bad distribution will reduce efficiency as well as capacity.

Poor maintenance on electrical switch-gear and distribution equipment can cause excessive energy losses.

Preventive maintenance improves equipment efficiency and reduces electric consumption...conserves energy... and saves you money.



Use outside air for cooling whenever possible

When outside air can be used for cooling, take advantage of it if possible...especially for buildings with interior zones that require year-round cooling.

What About Humidity? Humidity is not as big a problem as you might think. Some building operators hesitate to use outside air when the relative humidity is high to avoid bringing in excess moisture. Actually, relative humidity is not a major determining factor.

If the outside air is cool enough, it will seldom be too moist to be usable.

It is the *wet bulb temperature* that determines if outside air is suitable for cooling.

When to Use Outside Air. Outside air can be used for cooling even though the relative humidity is high if its dew point, or wet bulb thermometer reading, is *lower* than the design dew point of the building's cooling equipment.

You can find out what the wet bulb temperature is from the Weather Bureau. Or it can be measured with a suitable wet bulb instrument. If the equipment design dew point is not known, check with the manufacturer.



ENERGY
(KWHRS)
60%

Electric Demand Charge

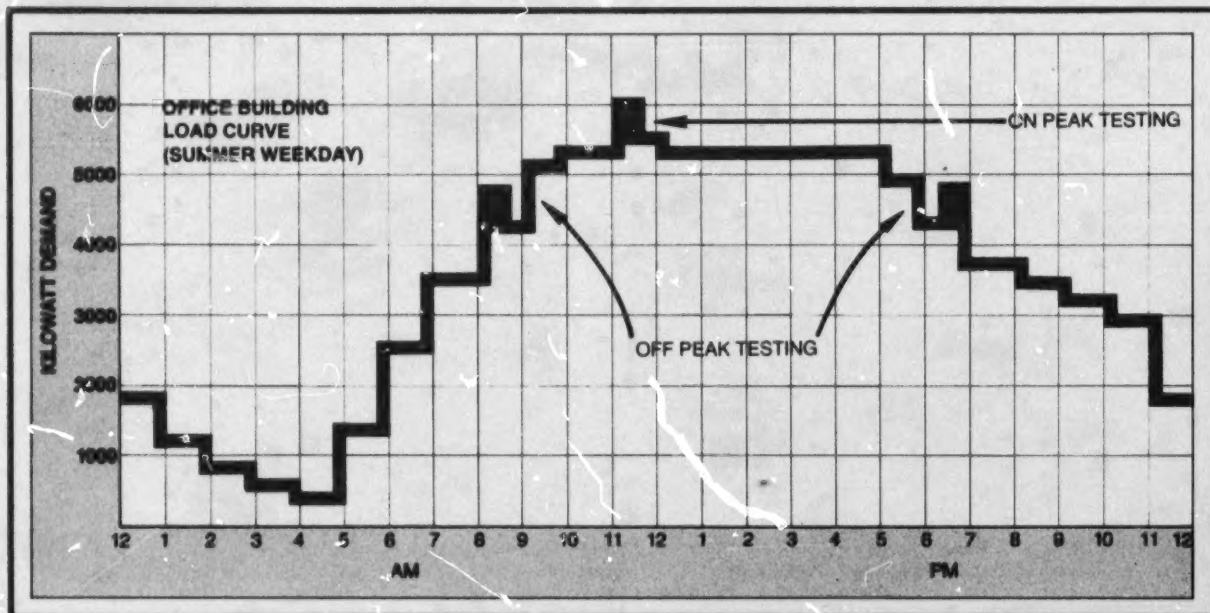
The second controllable element of your electric bill is the *demand charge*. For larger buildings in this area, the demand charge probably accounts for about 40 percent of the total electric bill.

With careful planning and scheduling you may be able to reduce your demand and thus reduce your bill. The demand charge is established over a short time span, within a period of 30 minutes, when all your electric energy requirements come on the line at the same time for one reason or another.

If you can shift some of your load off peak to other time spans you will take some of your demand off your peak. It's well worth trying.

Your Con Edison representative who advised you on Save-a-Watt and summer emergency load reduction energy conservation measures also may be able to help you reduce demand on a year-round basis.

The benefit of reduced demand extends beyond the utility customer's pocketbook. Electricity is generated to meet needs of the moment. When demand is lowered, less electricity is required, and less raw fuel—oil, coal, gas or nuclear energy—is consumed in power plants.



Avoid wasted demand

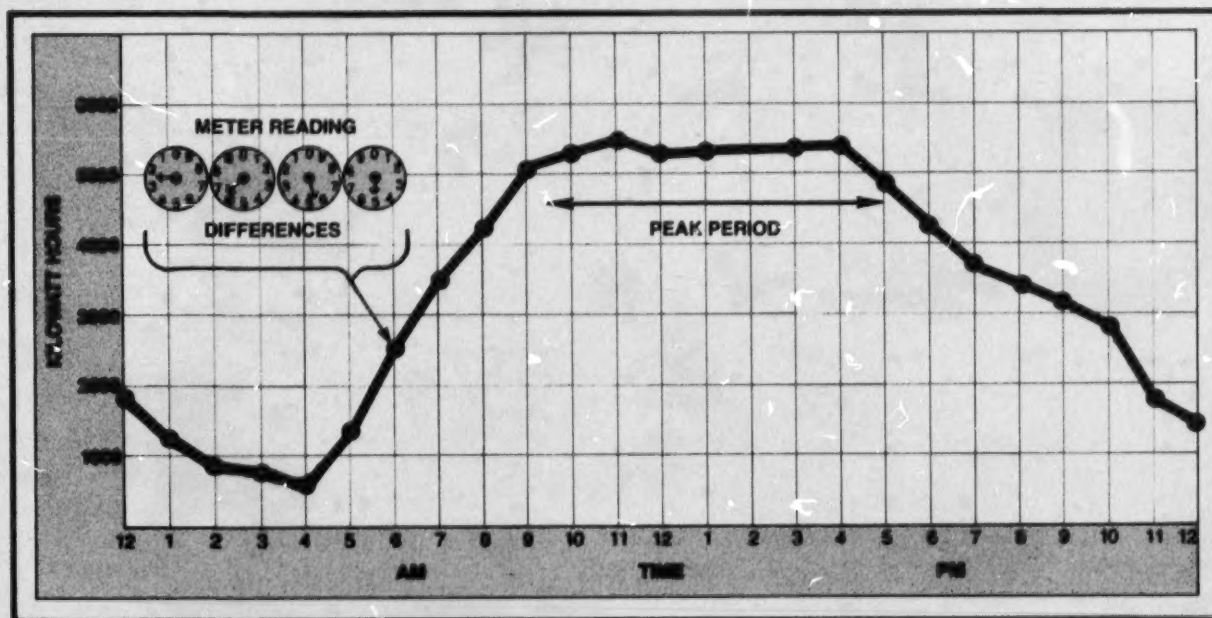
Here's a *hypothetical example* of wasted demand.

Assume that during a given billing period a building's load normally reaches a plateau in the 5400 kw range on weekdays over the seven hour period of 10 a.m. to 5 p.m. Sometime within this time span, during a 30 minute interval, the month's peak demand is recorded for billing purposes.

Auxiliary or emergency equipment representing 500 kw in additional load needs to be tested. If this is done on a weekday between 10 a.m. and 5 p.m. it will add 500 kw to the normal weekday demand plateau and could push maximum demand up to the 5900 kw range. At \$4.50 per kilowatt, a reasonable figure in this area, this untimely equipment testing could add about \$2,250 to demand charges for the billing period.

On the other hand, if the same equipment is tested *before* 9 a.m. or *after* 6 p.m., it would have no effect on peak demand and no additional demand charges would be incurred.

Obviously, testing of equipment (fire pumps, refrigeration compressors, motors, etc.) should be scheduled for periods when the building's demand is low.



Tips on how to reduce electric demand

Identify Peak Load Periods. Take kwh readings off your watt-hour meter at hourly intervals through the work day.

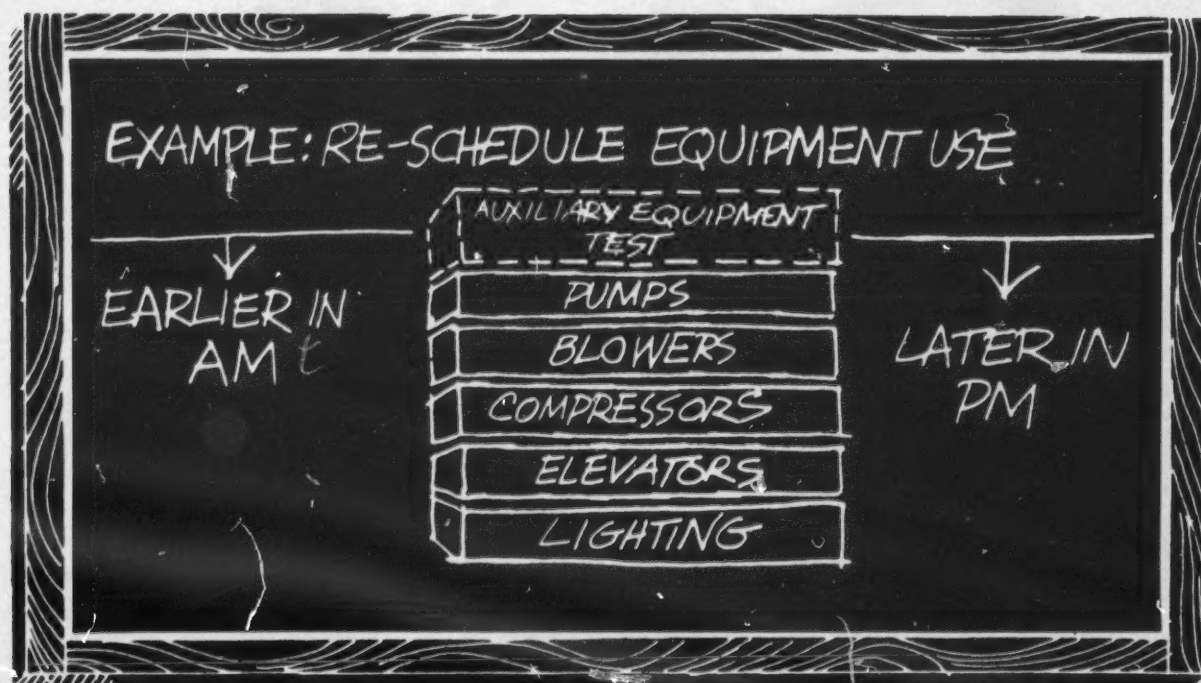
Calculate kwh of electricity used between readings as follows: subtract 1st reading from 2nd...then subtract 2nd from 3rd...etc. But each time *multiply the difference by the meter constant* shown as "K" on the face of the meter because some meter dials register a fraction of actual usage. This constant, or multiplier (usually 10) also appears on your bill.

Plot results on a chart. It will give you a reasonably accurate day's load curve from which you can identify peak use periods during which maximum demand is likely to be established. Repeat the process on several days. Compare curves to make sure one is not significantly different.

Identify On-Peak Equipment Use. Projected against your chart of electric use through the day, identify equipment operated during peak periods.

Major load contributors such as compressors, pumps and blowers can be identified readily enough. It may be harder to isolate smaller pieces of equipment which, in the aggregate, also contribute to demand.

To identify all load components, to evaluate their impact on peak demand, and to determine what measures you can take, a detailed study by a consulting engineer may be desirable.



Tips on how to reduce electric demand (continued)

Re-Schedule or Reduce Equipment Use. Having identified your peak load periods and the equipment used at these times, you should ask yourself two important questions:

1. Is simultaneous on-peak operation of all this equipment absolutely essential, especially big power users?

Or, can some of this usage be shifted before or after the peak period?

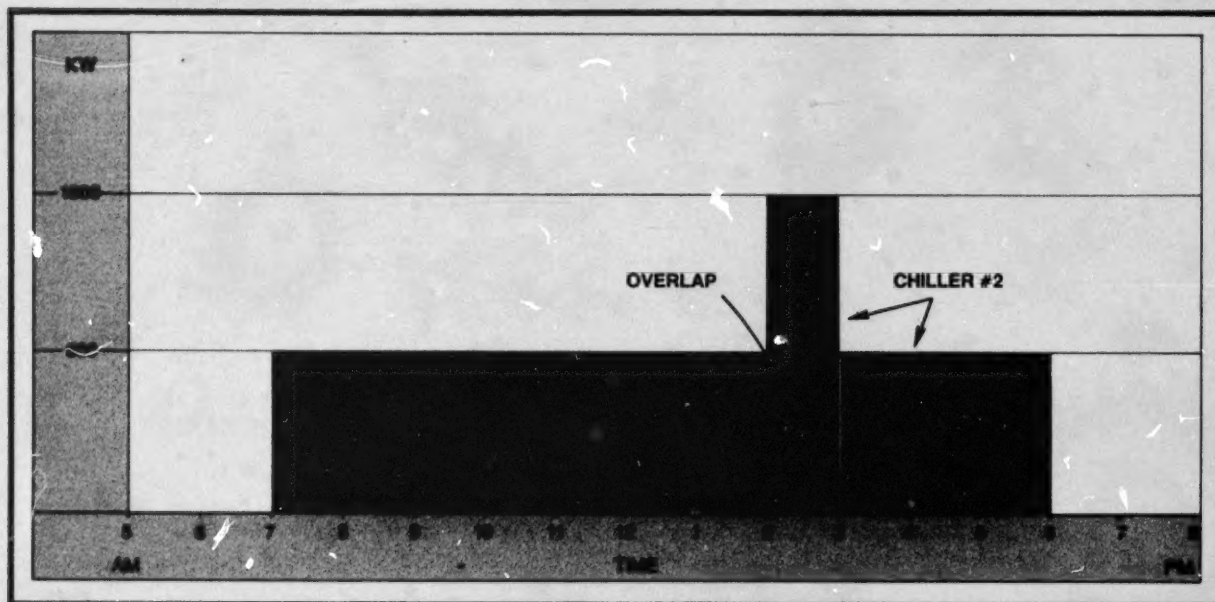
2. Is it really necessary to operate all this equipment at maximum capacity throughout the peak load period?

And is maximum capacity operation always essential at any other time, for that matter? Reducing off-peak equipment usage may not necessarily affect your peak demand, but it will reduce energy consumption.

Your answers to these questions may very well lead to significant reductions in both electric demand and energy charges.

Here again, the services of a consulting engineer can be helpful and may save you money in the long run.

Also, the possible use of computer peak load control devices should be investigated.



Avoid overlap in equipment operation

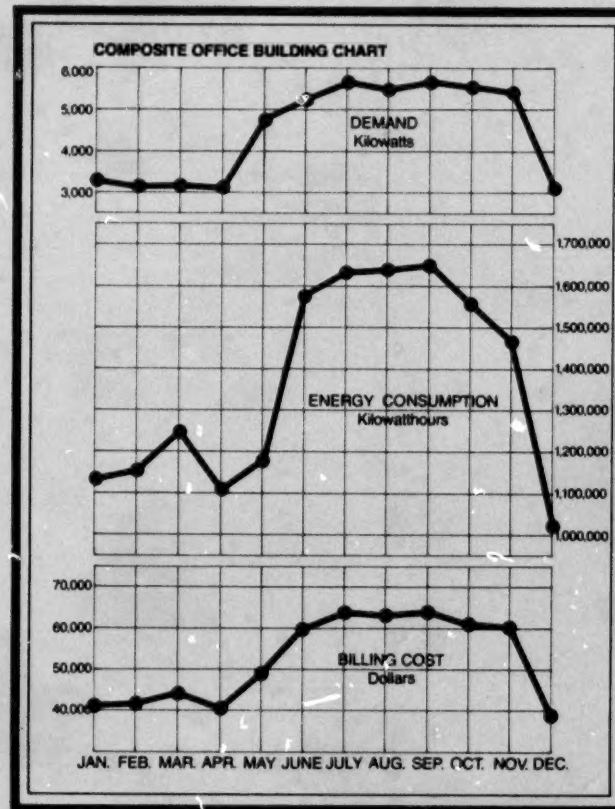
You can reduce demand waste by avoiding overlap in equipment operation whenever possible.

Take chiller operation as an example. You'll double the demand impact of chiller operation if you change chillers during your peak demand period and the operation of the two pieces of equipment overlaps long enough to register as billable demand.

Full capacity of many centrifugal chillers is only needed in hottest months. Capacity should be limited at other times to prevent excessive demand. The effect of chiller operation on demand can be controlled by starting equipment slightly earlier on extreme days and limiting the load as much as practical on moderate days.

Doubling up of such equipment operation during peak demand periods can easily cost you hundreds of dollars in demand charges. Rescheduling of equipment change timing can save you money.

The same logic applies to other equipment. Anytime you can avoid using *something* on peak you also may be avoiding higher demand charges.



Visualize and analyze the problem

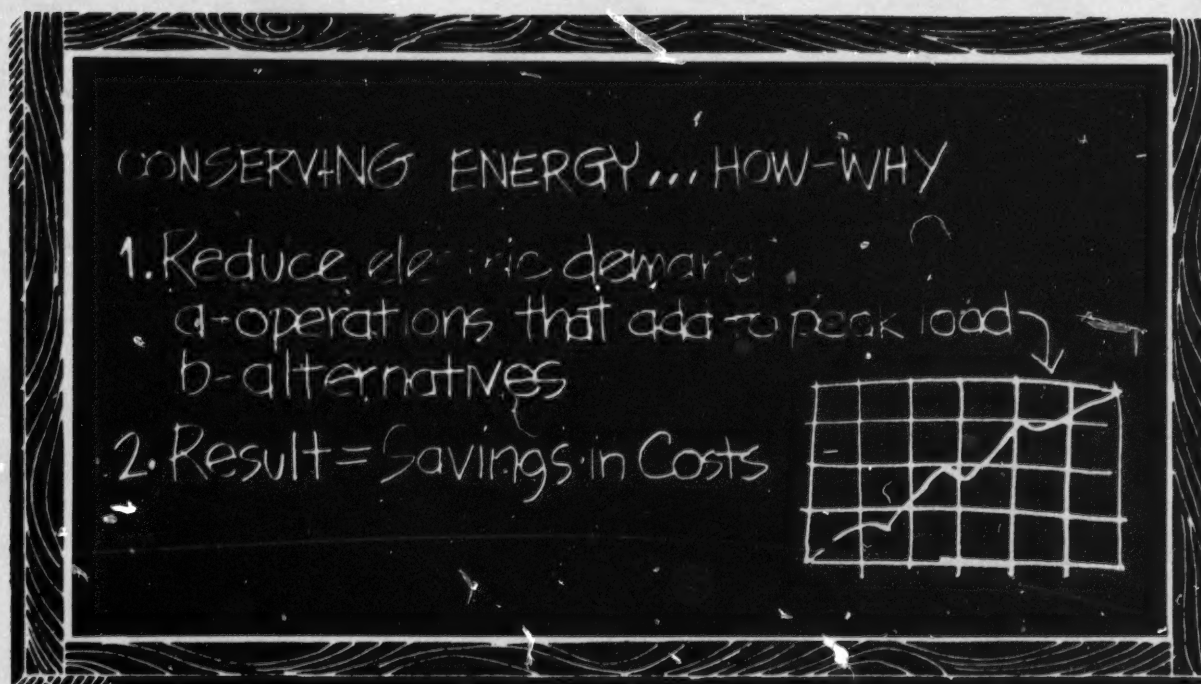
Electricity differs from other commodities. For all practical purposes, it's there when you want it, at the flick of a switch. You don't have to build up an inventory; and you never have to re-order. So it is all the more important to exercise continuing cost control—to analyze each month's usage, identify any waste, and act promptly.

One way to visualize the problem is to set up a chart, like the one above, to relate kilowatts of demand and kilowatt-hours of consumption to costs in dollars per month.

Plot the chart as you get your bills and study emerging patterns. The chart may indicate disparities that require investigation. It can also be helpful for long range planning and cost review. (In these inflationary times, make an appropriate note when rates go up.)

The composite office building chart above indicates that kilowatthour consumption dropped noticeably in March and in September and October while demand didn't change much. If this sort of disparity is questioned at an early stage there may still be time to improve performance.

Such analysis has to be made on the spot by operating people as conditions develop so that appropriate corrective action can be taken in time to be effective.



Organize energy conservation efforts

Get Personnel Support. You need full support of all operating personnel to reduce peak loads and energy consumption effectively on a continuing basis. Hold periodic meetings with building management staffs to motivate them. Brief the staff thoroughly. Make sure everyone understands why, how and when to conserve energy.

There are many ways to reduce electric demand and usage. Each building has unique features that only the operating staff knows how to exploit to fullest possible energy saving degree.

Review and Improve. In meetings with operating staffs, be sure to cover the impact of demand as well as usage on electric billing. Identify and review operations that contribute to peak demand. Analyze operation practices in effect through peak load periods. Adjust or reschedule, if possible, when necessary. Consider and evaluate alternatives. The end result can be continuing savings in your energy and demand costs—tangible benefit of a successful energy conservation effort.

Con
Edison

Should you want more help

Con Edison people who run a building and maintain its essential services throughout the year probably need the Con Edison people to help with the situation. After all, they are familiar with the building's electrical equipment and how to adapt it to these particular conditions.

Con Edison will work with another viewpoint can be helpful, if only to focus on the problem from a different perspective. If you need advice on your energy conservation program, Con Edison will work with you to find the best way to make it work.

Call your Con Edison Commercial Services representative. A review of your building's electrical system and emergency load reduction measures may indicate where more savings can be made.

Finally, we can help you analyze your requirements to determine if your situation requires the involvement of other experts. That's what we're here for.